APPENDIX B

FIELD FORM FOR HYDROLOGIC SURVEYS AND ANALYSES INSTRUCTIONS

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Field Form for Hydrologic Surveys and Analyses

Instructions

Background

The 3570 Manual issued September, 1963 spells out major direction in data collection and procedures. Briefly these changes include; the determinating of soil erosion and sediment production rates from forested lands; stratifying the watershed and sampling by strata; replacing the Hydrologic Condition Improvement Potential Curves with new techniques for predicting future runoff curve numbers, soil erosion, and sediment production rates; quantifying the physical and economic benefits of programs; determining the benefits forfeited if a program can not be fully implemented; and the preparation of a Hydrologic Survey and Analysis Summary.

HYDROLOGIC ANALYSIS

We are directed to make a comprehensive hydrologic analysis. How does the 3570 manual define a hydrologic analysis? "A hydrologic analysis as defined here evaluates factors which affect runoff and sediment production, isolates and quantifies their effects, and leads to the development of treatment and management practices needed to minimize flood runoff and soil movement." The hydrologic survey provides the basic data needed for the hydrologic analysis.

STRATIFICATION

The 3570 manual directs us to stratify the watershed as a basis for sampling. "The great amount of variation in the physical factors that affect runoff, soil movement and sediment delivery calls for a careful determination of what is to be sampled. One of the fundamental principles for increasing precision in sampling is to stratify the population into a minimum number of relatively homogeneous units."

Watersheds can be subdivided into physically homogeneous strata that will give the least variation in runoff and soil loss. The strata should be areas where the important factors that affect runoff and soil loss show strong uniformity. Such factors might include soils, geology, physiography, vegetation, land use and land ownership. The factors that are used to define a strata will vary between watersheds depending upon what data and maps are available and the watershed characteristics themselves.

Early in the survey, the factors to be used in defining the strata must be determined. Once these factors are identified, the field man should start collecting the data to stratify the watershed. For example, if the factors to be used are soils, vegetation, slope, land use and land ownership, then the surveyor must secure maps displaying these factors. Some maps might have to be synthesized by gleaning data from records and/or aerial photographs.

The next step is to combine these single factor maps into a stratified or category map. Category maps can be developed by using drafting techniques for very simple watersheds. However, we will use MIADS to develop category maps for complex watersheds.

FIELD SAMPLING

The 3570 manual directs us to sample "the strata to obtain estimates of amounts of erosion and detailed characteristics of the factors that affect erosion, sediment production, and storm runoff. As a result of stratification, sample areas are selected on the basis of soil-physiographs-vegetation homogeneity (FSM 3572.1) rather than on a random basis."

The attached field form and instructions display what data we will collect to meet the manual requirements for runoff, sheet and gully erosion. However, if we have the need and responsibility to evaluate road, streambank and landslide erosion, we will make special surveys to evaluate these conditions. Procedures for evaluating these are available.

SAMPLING INTENSITY

The manual states, "The number and distribution of field sampling locations cannot be specified precisely in advance. In most instances it probably will be beyond the realm of practicability to adequately sample all strata. Instead sampling must be carried out on representative parts of the stratum. The number of samples required depends on what is decided as necessary to provide an adequate knowledge of the characteristics and potentials of the area. The areal extent of certain strata; knowledge of soil, cover and land-use problems as obtained on the reconnaissance investigation, will serve as a guide to the location and amount of sampling required."

Because we are limited in time, money and men, we are forced to take a smaller sample than we would like for each strata. To compensate for this problem, we hope to build a data bank where we will accumulate data by strata. As we stratify watersheds, many strata will reoccur in several watersheds. As we sample recurring strata, we will add the new data to that from previous watersheds. As we accumulate data, the number of samples increase and our total sample approaches a statistical sample. When we have accumulated sufficient data for a strata, and when it recurs again we will only take a minimum sample to spot check the strata in new watersheds. This should speed up our field sampling.

DATA ANALYSIS

We are directed to make a data analysis to provide estimates of runoff and sediment production under existing and future conditions that will prevail with and without the recommended treatment and management. Thus, we will determine the existing runoff, soil erosion and sediment production rates, plus management problems and remedial measures for each stratum, and for our total area of responsibility. This data is expanded by using the category maps, the area of each stratum and MIADS.

We will predict what the future runoff, soil erosion and sediment production rates will be without any programs, with total implementation of the recommended program and with the anticipated level of compliance.

DETERMINING FUTURE CONDITIONS

How will we determine future conditions if we can no longer use the Hydrologic Condition Improvement Potential Curves? The 3570 manual states, "Familiarity with local conditions, comparisons with protected areas, fenced experimental plots, inaccessible areas, cemetaries, and reference to research results that relate timber and range-site productivity to soil and physiographic characteristics can be used to help make the estimates."

In other words, when we are surveying a watershed we should locate and identify areas that approximate expected future conditions and sample them to determine their runoff, soil erosion and sediment production rates. This data will be used to approximate what conditions might be obtained in time with improved management of problem areas. Local knowledge and field data will be used to project the impact of proposed programs under varying compliance levels.

Benefits Foregone

We will evaluate benefits forfeited if a program can not be fully implemented because of some factor. The difference between what the future conditions could be under total implementation of a program and that for the anticipated level of compliance are benefits foregone.

HYDROLOGIC SURVEY AND ANALYSIS SUMMARY

The manual states, "A brief factual summary of survey and analysis results (including maps and overlays developed) should be prepared upon completion of all field and office work. It is a working tool for field and office use and should: (1) document the estimates of flood runoff and soil loss for present and future conditions based on survey and data analysis and (2) present the treatment and management needs necessary to minimize or where satisfactory to maintain rates of storm runoff and soil loss." This is an in-Service report prepared by the hydrologist assigned to the party or by the person making the analysis.

The manual states, "The summary should begin with an introductory paragraph giving the name of the watershed, the location and drainage area, personnel involved and acknowledgements. Brief statements should follow covering important findings relating to the soil, cover, and physiographic characteristics of the watershed. A listing and description of the mapped stratum should be included. For each stratum, indicate rates of runoff and erosion and sediment for present and future conditions. Also, present the estimate of measures needed for protection and/or improvement of water-resource values."

Introduction

The following instructions and field form meet the requirements set by the 3570 Manual. The data requested by the form are designed to increase our knowledge of the forest lands being evaluated. The form calls for careful evaluation of soil, vegetation, erosion, sedimentation and runoff problems, plus the prescription of land management practices to reduce or eliminate these problems. This data is the basis for evaluating the watershed and program development.

The observer must make careful observations, however, he must not waste time. Usually, his first impression is the best. Second guessing leads to inconsistent data, which makes analysis difficult.

Plot Layout

Generally, a transect of three one-fourth acre plots should be located in a representative position in the strata. The transect should lie on the contour. This is a general rule, but if the watershed conditions warrant a change, this rule does not preclude the use of more or less plots per transect.

Recording Data

1. Print clearly.

2. Use capital letters, A, B, C, D etc.

3. All numerical values are to be right justified. For example _ 1 0.

4. Only one letter or number is put in each space for punching into IBM cards.

5. See attached completed form to see how data is to be recorded.

INSTRUCTIONS

Card Col.

1 1-5 Sequence No. Sequence number of transect in survey. A group of sequence numbers will be assigned each study.

6 Plot No. The plot number of the transect.

7 Card No. Already printed on form.

8-9 MIADS Category. Record the MIADS code for the category that is sampled by this plot. (For example, AB, 1X, *3)

10-12 Observer. Initials of person evaluating the transect.

13-16 Date. Month and year the transect was evaluated.

17-18 W.R.R. Record the Water Resource Region in which the sample is located, using the Atlas of River Basins of the United States, Soil Conservation Service, Second Edition, June 1970. For example - Lower Mississippi Region is 8. See attached WRR codes.

19-22 River Basin. Using the above Atlas, record the code for the river basin in which the transect is located. For example - 12, a, 1, g which represents Little River in the Lower Mississippi Region.

23-27 CNI w/s No. Record the CNI watershed number for the watershed in which the sample is located.

28-29 State. Record the state in which the transect is located. See attached table.

30-32 County. Record the county in which the transect is located. See attached table.

33-35 Iso-Erodent Factor. For the Modified Musgrave Equation, determine the Iso-Erodent Factor using the Iso-Erodent Map found in the Guide to Sedimentation Investigations., SCS, EWPU, Fort Worth, Texas, Revised July, 1968.

Management

Card Col.

1 36 Ownership. Ownership will be indicated by one of the following:

Code

1. Unknown
2. National Forest

3. Other Federal Forest
4. State
5. Other public non-Federal
6. Forest industry
7. Other industry
8. Private farm
9. Other

37 Land Use: Classify the plots primary land use as follows:

Code

1. Public forest
2. Water supply
3. Timber production
4. Forage production
5. Wildlife
6. Recreation, wilderness and scenic
7. Mineral, industry, urban
8. Other, or non-use
9. Urban

Card Col.

1 38 Type of Management: Indicate the type of management occurring on the plot.

Code

1. Unknown
2. Multiple use
3. Farm
4. Cooperative Forest Management (CFM)

5. Non-CFM

6. Industry

7. Urban Development

8. Absentee

39 Quality of Management in protecting soil and water, and other resources.

Code

1. Good

2. Fair

3. Poor

4. Unsuited to site

5. Exploitation

40-41 Old Field - If the land was once cultivated and has been abandoned or reverted to forest, estimate the number of years ago it was cultivated. If not an old field, record a zero.

42-43 Age of Disturbance - If there is evidence of past logging, mechanical site preparation, estimate the number of years ago it was logged or mechanical site prepared. If not, record a zero.

44-45 When Burned - If there is evidence of past fires, estimate the number of years ago it was burned. If not burned, record a zero.

Physiography

46-48 Percent Slope - Record the average slope for the plot.

49-50 Aspect - Record the general aspect of the plot. Use the eight major compass directions, that is, N, NE, E, etc.

51 Slope Position - The position of the plot on the slope is classified into one of four classes based on relative vertical distance of the plot above the water course into which the slope drains.

Class Code	Description
1. Lower Slope	Use for all rolling prairie, and Coastal areas; in mountainous, plateau, hill and bluff areas include stream bottomland and to one-quarter distance up slope from streambank to ridgetop.

2. Lower Middle Slope	One-quarter to one-half distance up slope; applies only to mountainous, plateau, hill and bluff areas.
3. Upper Middle Slope	One-half to three-quarters distance up slopes; applies only to mountainous, plateau, hill and bluff areas.
4. Upper Slope	Three-quarters distance up slope to and including ridgetop. Applies only to mountainous, plateau, hill and bluff areas.

Card Col.

52 Surface Geology - Identify the general rock type upon which the plot is located, if possible. For example - granite, sandstone, shale, etc. (Code to be developed later)

Omit

Soils

53-55 Land Resource Area - Record the number of the Land Resource Area the plot is sampling. The Land Resource Areas are assigned numbers and delineated on the River Basin Maps in the Atlas of River Basins of the United States, SCS, Second Edition, June 1970.

Soil Name. - Identify the soil, if possible, and record name.

56 Soil Texture of the soil surface is determined by the feel of moist soil when it is rubbed between thumb and fingers. The outstanding features of the main textural grades are described in FSH 2509.14, Soil Survey Procedures Handbook.

Class Code	Description
1. Sands	(Sand (Loamy Sand
2. Sandy Loams	(Fine Sandy Loam (Sandy Loam
3. Loams	(Silt Loam (Loam (Very Fine Sandy Loam

4.	Clay Loams	(Sandy Clay Loam (Silty Clay Loam (Clay Loam
5.	Clays	(Clay (Silty Clay (Sandy Clay

57 Soil Depth - Estimate the depth of soil to an impervious bedrock or hardpan. Depth estimates will be assigned to depth classes as follows -

Code	Depth Class
1.	0 - 10 inches
2.	10 - 20 inches
3.	20 - 40 inches
4.	40 - 60 inches
5.	60+ inches

58 Hydrologic Soil Group - Soil in each plot will be classified according to SCS hydrologic soil groups.

Code

A. Group A - Soils having high infiltration rates when thoroughly wetted, consisting chiefly of deep, well to excessively draineds and/or gravel. These soils have a high rate of water transmission and would result in a low surface runoff potential. The entire solum has a very low content of clay. (Deep loose sand to loamy sand would be typical of this group.)

B. Group B - Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. (Moderately deep and deep sandy loams to loams would be typical of this group.)

C. Group C - Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soil with a layer that impedes the downward movement of water, or (2) soil with moderately fine to fine texture and a slow infiltration rate. These soils have a slow rate of water transmission. These soils are heavy, probably ranging through silt loams to silty clay loams.

D. Group D - Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with a high swelling potential; (2) soils with a high permanent water table; (3) soils with a clay or pan or clay layer at or near the surface; and (4) shallow soils over nearly impervious materials. These soils have a very slow rate of water transmission.

59-61 K-factor - Record the K-factor (basic soil erosion rate) for the soil association being sampled. (Modified Musgrave Equation) If the K-factor data is not available, it can be keyed out using the soil surface texture, hydrologic soil groups, and the K-factor table that follows:

GUIDE FOR ESTIMATING ERODIBILITY (K) VALUES

Soil Surface Texture 1/	Hydrologic Soil Group			
	A	B	C	D
Clays	0.24	0.28	0.32	0.37
Clay Loams	0.28	0.32	0.37	0.43
Loams	0.32	0.37	0.43	0.49
Sandy Loams	0.20	0.24	0.32	0.37
Sands	0.17 or .15	0.20	0.24	0.28

Vegetation

1 62-63 Vegetation Type - Classify the vegetation type, evaluating one acre around the plot. To be classified as a forest type, the tree crowns must cover at least 10 percent of the area or the stand must contain at least 100 uniformly distributed trees of sampling size or larger, per acre. Record the forest type as defined in the Forest Survey Handbook FSH 4813.1.

Code	General	Code	Local types
00	White-red-jack pine. Forests in which eastern white pine, red pine, or jack pine, singly or in combination, comprises a plurality of the stocking. (Common associates include hemlock, aspen, birch, and maple.)	01	Jack pine
		02	Red pine
		03	White pine
		04	White pine-hemlock
		05	Hemlock
10	Spruce-fir. Forests in which spruce or true firs, singly or in combination, comprise a plurality of the stocking. (Common associates include white cedar, tamarack, maple, birch, and hemlock.)	11	Balsam fir
		12	Black spruce
		13	Red spruce-Balsam fir
		14	Northern white-cedar
		15	Tamarack
		16	White spruce
20	Longleaf-slash pine. Forests in which longleaf or slash pine, singly or in combination, comprises a plurality of the stocking.	21	Longleaf pine
		22	Slash pine
30	Loblolly-Shortleaf pine. Forests in which loblolly pine, shortleaf pine, or other southern yellow pines except longleaf or slash pine, singly or in combination, comprises a plurality of the stocking. (Common associates include oak, hickory, and gum.)	31	Loblolly pine
		32	Shortleaf pine
		33	Virginia pine
		34	Sand pine
		35	Eastern Redcedar
		36	Pond pine
		37	Spruce pine
		38	Pitch pine
		39	Table-mountain pine
40	Oak-pine. Forests in which hardwoods (usually upland oaks) comprise a plurality of the stocking but in which pines comprise 25 to 50 percent of the stocking. (Common associates include gum, hickory, and yellow poplar.)	41	White pine-northern red oak-white ash
		42	Eastern redcedar-hardwood
		43	Longleaf pine-scrub oak
		44	Shortleaf pine-oak
		45	Virginia pine-southern red oak
		46	Loblolly pine-hardwood
		47	Slash pine-hardwood
		49	Other oak-pine

Code	General	Code	Local Types
50	Oak-hickory. Forests in which upland oaks or hickory, singly or in combination, comprises a plurality of the stocking, except where pines comprise 25 to 50 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, maple, and black walnut.)	51	Post oak, black oak, or bear oak
		52	Chestnut oak
		53	White oak-red oak-hickory
		54	White oak
		55	Northern red oak
		56	Yellow poplar-white oak-northern red oak
		57	Southern scrub oak
		58	Sweetgum-yellow poplar
		59	Mixed hardwoods
60	Oak-gum-cypress. Bottomland forests in which tupelo, blackgum, sweetgum, oaks, or southern cypress, singly or in combination, comprises a plurality of the stocking except where pines comprise 25 to 50 percent in which case the stand would be classified oak-pine. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)	61	Swamp chestnut oak-cherrybark oak
		62	Sweetgum-Nuttall oak-willow oak
		63	Sugarberry-American elm-green ash
		65	Overcup oak-water hickory
		66	Atlantic white cedar
		67	Baldcypress-water tupelo
		68	Sweetbay-swamp tupelo-red maple
70	Elm-ash-cottonwood. Forests in which elm, ash, or cottonwood, singly or in combination, comprises a plurality of the stocking. (Common associates include willow, sycamore, beech and maple.)	71	Black ash-American elm-Red maple
		72	River birch-sycamore
		73	Cottonwood
		74	Willow
		75	Sycamore-pecan-American elm
80	Maple-beech-birch. Forests in which maple, beech, or yellow birch, singly or in combination, comprises a plurality of the stocking. (Common associates include hemlock, elm, basswood and white pine.)	81	Sugar maple-beech-yellow birch

Code	General	Code	Local types
90	Aspen-birch. Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, comprises a plurality of the stocking. (Common associates include maple and balsam fir.)	91 92	Aspen Paper birch
95	Grassland		
96	Marsh		
97	Chapparal		
99	Other - Specify in remarks. To be classified as range, grasses, forbs, and low shrubs must dominate the aspect and whose foliage covers more than 10 percent of the ground area.		

64-66 Crown Density - Crown density is estimated on the basis of percentage of ground covered by a vertical projection of tree and shrub crowns into the ground.

1 67 Stand Size - Using Forest Survey criteria, forest land will be classified using the size of growing stock trees on the area; that is, sawtimber, poletimber, or seedlings and saplings.

Code

0. If a stand is not present.

1. Sawtimber Stands - Stands at least 10 percent stocked with growing stock trees, with half or more or total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking.

2. Poletimber Stands - Stands at least 10 percent stocked with growing stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees, and with poletimber stocking exceeding that of sawtimber.

Code

3. Sapling-Seedling Stands - Stands at least 10 percent stocked with growing stock trees of which more than half of the stocking is saplings and/or seedlings.

Tree Sizes are as follows:

Sawtimber trees - Live trees of commercial species containing at least a 12-foot saw log and meeting Regional specifications for freedom from defect. Softwoods must be at least 9.0 inches in diameter breast height.

Poletimber trees - Growing stock trees of commercial species at least 5.0 inches in d.b.h., but smaller than sawtimber size.

Saplings - Live trees 1.0 inch to 5.0 inches in d.b.h.

Seedlings - Live trees less than 1.0 inch in d.b.h. that are expected to survive according to Regional standards.

Card Col.

1 68-70 Basal Area - (Sq. ft.) of all sizes and species of trees taken from center of plot.

71 Stocking - Stocking is divided into two merchantable categories - one based on the total stocking, the other based on the merchantable or potentially merchantable stocking. Degree of stocking is the ratio expressed as a percentage of the number of trees in the stand to the number of trees required to occupy the site fully.

Code

1. Seventy percent or more is well stocked.

2. Forty percent to 69 percent is medium stocked.

3. Less than 40 percent is poorly stocked.

0. If unstocked.

72-74 Ground Cover - Percent of the plot covered by vegetal material (both live vegetation and litter).

75-77 Rock - Percent of the plot that is covered by rock outcrops and rock fragments larger than 3/4" across.

78-80 Bare Ground - Percent of plot which is covered by bare ground. Bare ground is exposed soil and rock fragments up to 3/4" across.

Card Col.

2 8-10 (42-44) Disturbance - Each plot is disturbed by one or more causes. If only one disturbance, leave (42-44) blank.

Code

N. Natural or Undisturbed.

L. General Logging - The plot area which has been exposed by removing the first canopy, but has not been mechanically disturbed by tractos or skidding logs.

S. Skid Trails

D. Decks - Landings

R. Spur Roads

I. Insects

B. Fire

W. Wildlife - Describe disturbance and species causing the damage.

G. Livestock Grazing

Site Preparation

K. KG blade

A. Root Raking

C. Chopping

X. Discing

T. Straight Blade same as bulldozing

M. Mining

Ø. Other - Specify in remarks

E. Bedding

Card Col.

2 11-13 (45-47) Percent of Plot - Record the percent of the plot (outside of gully in stream channels) that has been disturbed or exposed by each disturbance or combination of disturbances. For example:

General logging and fire	80
Skid trails	20
	100

Musgrave Soil Erosion - The Modified Musgrave Equation will be used to evaluate normal sheet erosion if we have soil information available.

14-18 (48-52) Cover Factor - Record the cover factor using the following tables. If you are going to use the Estimated Erosion procedure, leave blank. same as % bare ground

19-21 (53-55) % Slope - The average percent slope within the disturbance being evaluated. Record even if estimating the erosion.

22-24 (56-58) Slope Length - The length of slope from highest point that drains through the plot to the first definite obstruction encountered by surface flow (such as a water course, depression, bench or ridge) for each disturbance to use in the Musgrave Soil Erosion Equation. Maximum length is generally less than 200 feet.

Estimated Erosion - The Musgrave Equation is designed to evaluate normal sheet erosion. Accelerated sheet and rill erosion is evident, the depth of erosion is estimated by the observer. If using Musgrave, skip to Percent to Stream.

25-29 (59-62) Inches Eroded - Estimate sheet and rill erosion (rills less than 6 inches deep) to the nearest 0.1 inch for each of the disturbed areas.

Soil Erosion Indicators

- - Erosion pavement - layer of rocks on soil surface

- - Erosion pedestals - Pebbles, leaves, twigs, grass or other perched on pedestals of disturbed soil; large mounds may indicate erosion over a long period of time.

- - Unscorched collars of shrub stems - Depth of erosion following fire.

- - Light colored collars on rocks - May be similar but not as conclusive as litter may have burned away in fire.

- - Exposure of bedrock - Newly exposed surface different in color.

RELATIVE RATES OF EROSION UNDER VARIOUS GROUND DENSITIES OF RANGE COVER TYPES

Ground Cover Density	Musgrave Cover Factor
5	.60 - .70
10	.50 - .60
15	.40 - .50
20	.35 - .45
25	.30 - .40
30	.20 - .30
35	.18 - .28
40	.16 - .25
45	.13 - .23
50	.10 - .20
55	.09 - .18
60	.08 - .17
65	.07 - .15
70	.05 - .13
75	.04 - .10
80	.04 - .09
85	.03 - .08
90	.02 - .07
95	.01 - .06
100	.002 - .05

RELATIVE RATES OF EROSION UNDER VARIOUS FOREST CONDITIONS

(Based on Forest Service--S&PF (NA) Soil Loss Study in Susquehanna River Basin)

Descriptions (Management, use and disturbances)	Surface compaction	Musgrave cover factor
Forest land relatively undisturbed in past 25 years Well-managed mature stands.	Loose	.001 - .002
Forest land relatively undisturbed in past 5 years. May have light logging damage.		
Most managed stands (public-owned lands; some forest management cooperators, wood-using industries and municipal watershed lands).	Loose	.001 - .003
Heavy second-growth sawtimber and pole stands (160 B.A./Ac).	Loose	.002 - .005
Moderate-to-heavy second growth sawtimber, pole, and sapling stands (50--150 B.A./Ac).	Moderately compact to loose	.003 - .007
Seedlings, saplings, light sawtimber and pole stands (50 B.A./Ac).	Moderately compact to loose	.004 - .009
Forest land disturbed during past 5 years		
Generally any stand lightly grazed or having moderate cutting and logging damage.	Moderately compact	.005 - .016
Stands having heavy cutting and logging damage; or moderately grazed or burned.	Moderately compact	.002 - .023
Idle farmland reverting to trees, generally seedling and sapling stands.	Moderately compact	.016 - .039
Stands heavily brazed or burned.	Compact	.026 - .089
Stands severely burned or grazed, humus lacking, erosion plainly visible	Compact	Record percent bare ground as cover factor.

Card Col.

- - Exposed roots, exposed root crown, stilt-type roots - Normal depth of roots and corwns may help establish soil loss; age of plant may help with time relationship.

- - Lateral ridges of soil material, mud flows - Deposition from area above.

- - Deposits in ditches, hillside depressions, gentle slopes and bench deposits - Deposition from above, check for burned material for time relation.

29-30 (63-64) Years of Estimate - Record the number of years for which erosion is estimated by cause. It is recommended that the number of years for each cause be consistent within the plots and transect. For example, all erosion evaluations for all causes should be based either for one year since the disturbance, or for a prescribed time period. This will simplify the subsequent data analysis.

Annual or one-year period - One year soil erosion indicators are pedestals with small stones, and last year's leaves, needles, twigs, and grass litter perches on top.

Since disturbance - Logging, fire and land use history and/or local knowledge can help determine the date of the disturbance. If such information is not available, the observer can use past experience and/or the age of the vegetation that has invaded the disturbed area to determine the date of the disturbance.

Prescribe period - Age of vegetation, local knowledge and experience are used in determining the erosion for a prescribed period of time.

31-33 (65-67) Percent to Stream - Estimate the percent of the sheet and rill erosion that reaches a stream for the evaluation period. Position on the slope, distance to established channel, intervening vegetation, litter, disturbances, and deposition areas are important factors to consider in making the estimate. A very useful tool is the soil textural triangle on the following page. For example, if the soil being sampled once had a surface texture of clay loam, but now has a sandy surface, the fine material has been removed by erosion leaving the sand fraction behind. On the average, clay loam has 35 percent sand with silt and clay composing 65 percent. If no evidence of clay and silt deposition can be found below the point of evaluation, then at least 65 percent of the soil erosioned has been removed and can be considered sediment. Therefore, the percent to stream would be 65 percent.

RCN Evaluation - A runoff curve number will be determined for each disturbance.

Card Col.

2 34-36 (68-70) Litter Depth - Record the average litter depth to the nearest 0.1 inch for each disturbance. It consists of undecomposed leaves and/or needles, together with twigs, bark, etc. If less than .05 inches; record a zero.

37-40 (71-74) Humus Depth - Record the average humus depth to the nearest 0.1 inch for each disturbance. Humus is the organic layer, unrecognizable as to origin, lying immediately beneath the litter layer, from which it is derived. It may consist of -

Mulls consisting of the A_1 horizon of an intimate mixture of organic matter and mineral soil, or

Mors consisting of the "H" layer or A_{02} horizon which is practically pure organic matter, unrecognizable as to origin, lying on the mineral soil.

41 (75) Humus Compaction - Humus is very sensitive to land use and treatment. Under good use and treatment, it is porous and has high infiltration and detention storage capacities, but poor management practices such as burning, overcutting, and overgrazing convert porous humus to a compact one which impedes the absorption of water. Since compaction is the principal factor affecting infiltration, and because the degree of compaction is closely related to humus type, humus type is used as the criterion for compaction.

Three degrees of compaction, as expressed by compaction factors, are recognized in determining hydrologic condition:

Code

C. Compact: Characterized by firm mull or felty mor.
Firm Mull: A_1 horizon, an intimate mixture of mineral soil, with gradual transition to underlying horizon, and with generally less than 5 percent organic matter by weight; massive and firm.
Felty Mor: "H" layer with practically no mixing of organic matter with mineral soil, abrupt transition from surface organic matter to underlying horizon, feels and looks felty due to the presence of fungal hyphae and/or plant residues but no living roots.

M. Moderately Compact: Characterized by transitions between (1) firm mull and other mulls and mors other than felty mors, (2) felty mors and other mors, and mulls other than firm mull.

Card Col.

L. Loose, not compact, friable: Characterized by mulls other than firm mulls and mors other than felty mor. Record the humus compaction by using either C, M, or L, in the block.

3 8 (25) Number of Gullies - Record the number of gullies being evaluated. If no gullies occur, enter zero in both these columns.

9-11 (26-28) Cause - Record the cause or disturbance affecting the erosion of the gully or first order channel. Look for the same disturbances as listed for the sheet erosion evaluation.

12-14 (29-31) Total Length (Ft.) - Record the length of gully or gullies within the plot.

15-19 (32-36 X-Section Area (Sq. Ft.) - Record the average cross-sectional area in square feet for the gully or gullies that occurred during the period being evaluated.

20-21 (37-38) Years of Estimate: Record the number of years for which gully is being evaluated.

Percent to stream - Estimate the percent of gully erosion that reaches a stream for the evaluation period.

Cause of Erosion - Briefly describe why the erosion is occurring and the intensity of disturbance. Consider the following -

a. Type, frequency and intensity of burns.

b. Type of logging, equipment used.

c. The location, construction, and post-logging treatment of landings, skid trails and spur roads.

d. Grazing pressure by livestock, trailing, etc.

e. Evaluate wildlife populations, browsing, trailing.

f. Mines, rights-of-way, etc.

In considering the Intensity of Disturbance, use the following as a guide -

Intensity of Disturbance - Damage to vegetation and litter due to disturbance by fire, grazing, logging, etc., is classified primarily on the basis of effects on soil stability.

1. Fire Damage

a. Negligible - No evidence of past fires.

b. Light - No evidence of fires during past 15 years, but marks of older fires evident.

c. Moderate - Evidence of recent fires, bare or puddled soil.

d. Severe - Recent fires or repeated past fires hot enough to kill trees and open up canopy; evidence of fire-induced erosion.

2. Animal Damage - (Domestic and Wildlife)

a. Negligible - Use only when no sign of grazing can be found.

b. Light - A few signs of current use of more palatable species or old, presently unused livestock trails.

c. Moderate - Current use of more palatable species with obvious signs of trailing and trampling and some bare soil.

d. Severe - Considerable bare soil, heavy browsing and shortage of undergrowth; sheet or gully erosion attributable to grazing use.

3. Logging Damage

a. Negligible -No evidence of logging.

b. Light - Some logging has been done but damage to soil and reproduction is no longer obvious.

c. Moderate - Considerable opening of canopy by timber cutting and localized erosion in roads and skid trails.

d. Severe - Denudation of large areas by timber cutting, severe erosion of roads and skid trails; surface runoff is being concentrated by skid trails and roads; streams blocked or diverted from natural channel.

4. Other Damage - Degree of disturbance by other sources where it occurs, such as recreation, mining activity, and rights-of-way, will likewise be defined and classified as negligible, light, moderate, or severe.

Cause of Sediment Production - Briefly describe why there is sediment production considering the same items as above, plus the location of these disturbances with reference to streams, topography, etc.

Remedial Measures - Land treatment measures are those measures that are needed to protect and improve water resource values. Guided by on-the-ground observations of such factors as degree of deterioration, type of soil, physiography, accessibility, and use, indicate land treatment needs that might be applied to reduce or to hold storm runoff and sediment production to a minimum rate for the site.

Vegetal - Vegetative Land Treatment - Consider vegetative treatment and vegetative protection needed for water resource improvement and protection purposes (FSM 3510, FSH 2509.11, Land Treatment Measures Handbook). Review local situations with research personnel.

The following items can serve as a guide in the development of recommended measures -

1. None. Present conditions, trends, and management are satisfactory. No change in management anticipated.

2. Protection. Protection from fire, insects, and disease. Certain areas should not be programmed for prescribed burning. Consider soil erodibility characteristics, slope, and grazing use.

3. Forest Management

   a. Silviculture consideration, including type conversion, stand density adjustment, and silviculture cutting treatment.

   b. Harvest methods, including location and standards for future roads and skid trails, maintenance limitation of equipment use, and time and season factor.

4. Rehabilitation. Reforestation of afforestation needs for watershed protection and/or water quality purposes.

5. Grazing Control. Includes grazing management needs, proper stocking, season of use, trespass control, fencing, cattle guards, and water developments.

6. Seeding of Grasses, Forbs, and Browse. This treatment should be recommended where vegetative cover has been so depleted as to preclude natural vegetation within reasonable time limits. It could be recommended on abandoned agricultural lands.

7. Road and Trail Stabilization. This could consist of cut-and-fill stabilization, water bars, energy dissipaters at culvert or cross-drain outlets, and abandonment measures such as outsloping, scarifying, planting, and blocking from futher use.

Costs - Estimate the costs of vegetative land treatments for each plot.

Structural or Mechanical Measures - Where water resource improvement and protection objectives cannot be attained through vegetative measures alone, consideration should be given to structural and mechanical measures (FSH-2509.12, Watershed Structural Measures Handbook). The following items should be considered.-

1. Water Retention and Detention. Includes all measures designed to reduce runoff, increase infiltration, and improve storage capacity of the soil.

2. Drainage. Indicate if drainage is needed to correct damage either from concentration of water, as in inadequate drainage of roads or unstable soils (landslide areas), or from undersirable drainage, as from deep gullies through meadows which have resulted in lowering water tables to undesirable levels.

3. Soil Stabilization. Includes all mechanical measures designed to control soil erosion. Includes temporary measures to permit vegetation treatment to become effective. Examples are gully plugs, water spreaders, contour trenches, terraces, wattling, mulching, and shaping.

Costs - Estimate the costs of structural or mechanical measures for each plot.

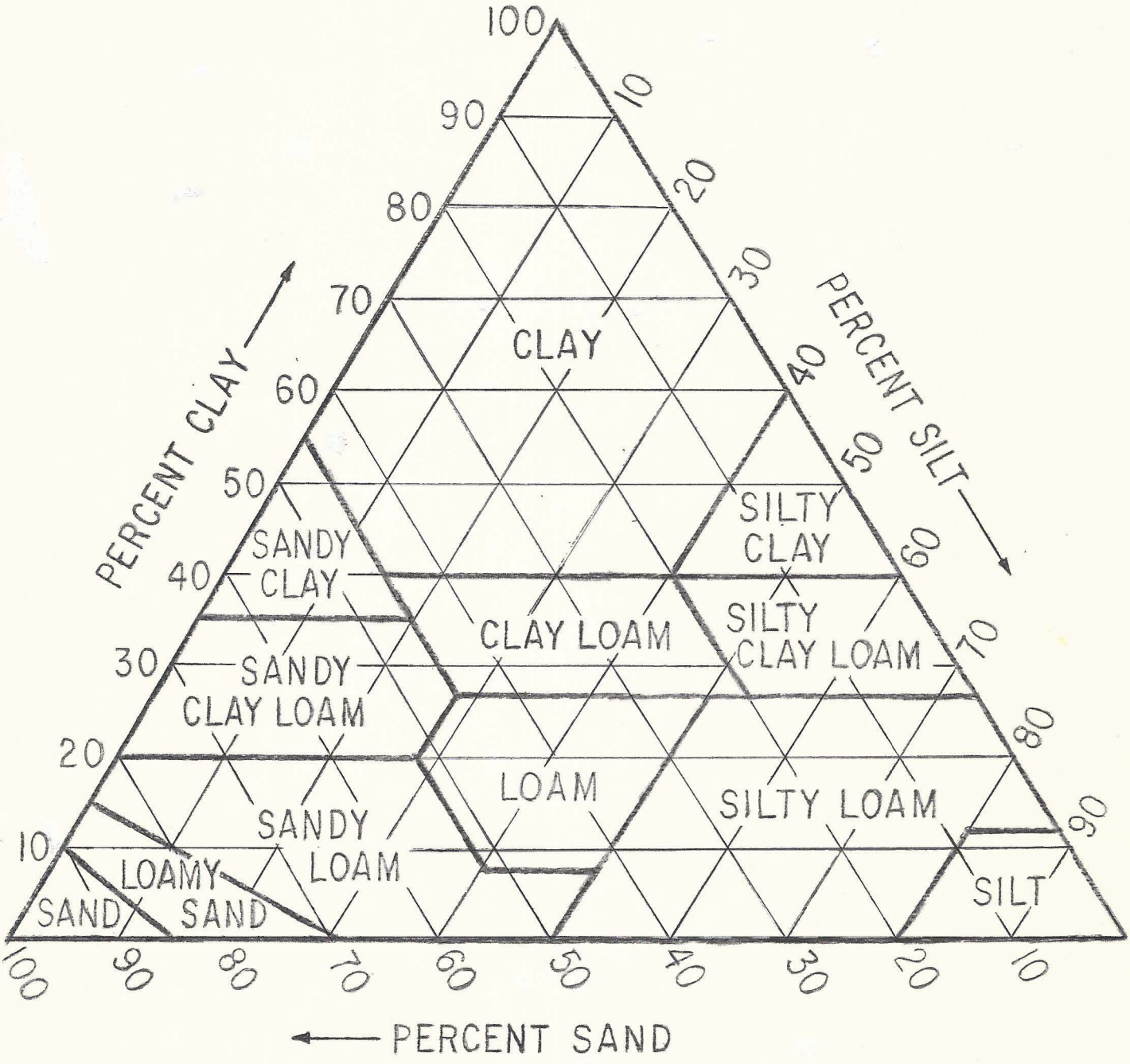
Management Recommendations - Discuss management measures needed to minimize or prevent the development of future runoff, erosion and sediment production problems. For example, change of land use, buffer strips, zoning of land use, etc.

Remarks - Record any other pertinent information here.

Back of form - Optional items.

WATER RESOURCE REGIONS

REGION	CODE
Northeast Atlantic	1
Mid-Atlantic	2
South Atlantic-Gulf	3
Great Lakes	4
Ohio	5
Tennessee	6
Upper Mississippi	7
Lower Mississippi	8
Souris-Red-Rainy	9
Missouri	10
Arkansas-White-Red	11
Texas-Gulf	12
Rio Grande	13
Upper Colorado	14
Lower Colorado	15
Great Basin	16
California-South Pacific	17
Columbia-North Pacific	18
Alaska	19
Hawaii	20


100
90
80
70
60
50
40
30
20
10
PERCENT CLAY
PERCENT SILT
PERCENT SAND
CLAY
SILTY CLAY
SANDY CLAY
CLAY LOAM
SILTY CLAY LOAM
SANDY CLAY LOAM
LOAM
SILTY LOAM
SANDY LOAM
LOAMY SAND
SAND
SILT

U.S. Department of Agriculture-Forest Service

APPENDIX B

FIELD FORM FOR HYDROLOGIC SURVEYS AND ANALYSES

Sequ. No.	Pl. No.	Cd No.	MIADS Cat.	Obser. Initials	Date Mo.	Date Yr.	Location W.R.R.	Location River Basin	Location CNI W/S	Location State	Location County	Precip. Iso-Erod. Fact
3211	24	1	AL	GED	07	72	7	2A	1C	03	113	30
1 2 3 4 5	6	7	8 9	10 11 12	13 14	15 16	17	18 19	20 21 22	23 24	25 26 27	28 29 30 31 32	33 34	35

Management: Ownership	Management: Land Use	Management: Type	Management: Quality	Land Use History: Old Field	Land Use History: Logged	Land Use History: Burned	Physiography: % Slope	Physiography: Aspect	Physiography: Slope Pos	Surface Geology	LRA
6	3	3	2	30	1	1	15	E	3		139
36	37	38	39	40	41 42	43	44	45	46 47 48 49 50	51	52	53 54 55

Soil: Name	Soil: Texture	Soil: Depth	Soil: HSG	Soil: K-Fact.	Vegetation: Type	Vegetation: Crown Density	Vegetation: Stand Size	Vegetation: Basal Area	Vegetation: Stocking	Vegetation: % Gr. Cov.	Vegetation: % Rock	Vegetation: % Ba. Gr.
	25	5	B	.29	31	15	2	30	3	20	0	30
	56	57	58	59 60 61	62 63	64 65 66	67	68 69	70 71	72 73 74	75 76 77	78 79 80

Cd. No.	Disturbance	% of Plot	Musgrave: C-Factor	Musgrave: % Slope	Musgrave: Slope Length	Estimate Erosion: Inches Eroded	Estimate Erosion: Yrs. Est.	% To Stream	Litter Depth	Humus: Depth	Humus: Compaction
2	LO	90	.300	15	150	.		5	.0	1.0	C
7	8 9 10	11 12 13	14 15 16 17 18	19 20 21	22 23 24	25 26 27 28	29 30	31 32 33	34 35 36	37 38	39 40	41

Disturbance	% of Plot	Musgrave: C-Factor	Musgrave: % Slope	Musgrave: Slope Length	Estimated Erosion: Inches Eroded	Estimated Erosion: Yrs. Est.	% To Stream	Litter Depth	Humus: Depth	Humus: Compaction
S	10	.95	12	50	.		15	.0	.0	C
42 43 44	45 46 47	48 49 50 51 52	53 54 55	56 57 58	59 60 61 62	63 64	65 66 67	68 69 70	71 72 73 74	75

Cd. No.	No. of Gullies	Causes	Gully Length	X-Sectional Area	Yrs. of Estimate	% To Stream	No. of Gullies	Causes	Gully Length	X-Sectional Area	Yrs. of Estimate	% To Stream
3	1	S	50	2.5	1	30	0			.		
7	8	9 10 11 12 13 14	15 16 17 18 19	20	21	22 23 24	25	26 27 28	29 30 31	32 33 34 35	36 37	38 39 40 41

Cause of Erosion: Control burn to hot.

Cause of Sedimentation: No buffer left between logged area and stream

Remedial Measures

Vegetal: Cost:

Structural: Cost:

Land Management Recommendations: The skid trail should have been waterbarred and seeded. Need a buffer. Burning logging debris was to hot, a light fire was all that was needed.

Remarks:

SA-3500-1 (5/71)

DISSMEYER "FASS" INSTRUCTIONS

Code List For Field Form

For Hydrologic Surveys and Analyses

Item Codes (36) Ownership
1. Unknown
2. National Forest
3. Other Federal Forest
4. State
5. Other Public
6. Forest Industry
7. Other Industry
8. Farm
9. Other

(37) Land Use
1. Public Forest
2. Water Supply
3. Timber Production
4. Forage Production
5. Wildlife
6. Recreation, Wilderness, and scenic
7. Mineral, industry, urban
8. Other, or non-use
9. Urban.

(38) Type of Management
1. Unknown
2. Multiple Use
3. Farm
4. CFM
5. Non-CFM
6. Industry
7. Urban Development
8. Absentee

(39) Quality of Mgt.
1. Good
2. Fair
3. Poor
4. Unsuited to site
5. Exploitation

Item Codes (40-1) Old Field
No. of yrs. since abandonment, for ex. 45
If not an old field, record a zero.

(42-3) ~~Logged~~ Disturbed
No. of yrs. since logging, for ex. 12
If not ~~logged~~, record a zero.

(44-5) Burned
No. of yrs. since burned, for ex. 5
If not burned, record a zero.

(51) Slope Position
1. Lower
2. Lower Middle
3. Upper Middle
4. Upper

(56) Texture of Soil Surface
1. Sands
2. Sandy Loams
3. Loams
4. Clay Loams
5. Clays

Item Codes (57) Depth-Soil
1. 0-10 inches
2. 10-20
3. 20-40
4. 40-60
5. 60+

(58) HSG-Hydrologic Soil Group
A. Group A
B. Group B
C. Group C
D. Group D

Item Codes (62-3) Type of Vegetation

00 White-red-jack pine
01 Jack pine
02 Red pine
03 White pine
04 White pine-hemlock
05 Hemlock

10 Spruce-Fir
11 Balsam fir
12 Black spruce
13 Red spruce-Balsam fir
14 Northern white cedar
15 Tamarack
16 White spruce

20 Longleaf-slash pine
21 Longleaf pine
22 Slash pine

30 Loblolly-Shortleaf pine
31 Loblolly pine
32 Shortleaf pine
33 Virginia pine
34 Sand pine
35 Eastern red cedar
36 Pond pine
37 Spruce pine
38 Pitch pine
39 Table-mountain pine

40 Oak - pine
41 White pine-northern red oak-white ash
42 Eastern red cedar-hardwood
43 Longleaf pine-scrub oak
44 Shortleaf pine-oak
45 Virginia pine-southern red oak
46 Loblolly pine-hardwood
47 Slash pine-hardwood
49 Other oak-pine

50 Oak - hickory
51 Post oak, black oak or bear oak
52 Chestnut oak
53 White oak-red oak-hickory
54 White oak
55 Northern red oak
56 Yellow poplar-white oak-northern red oak
57 Southern scrub oak
58 Sweetgum-yellow poplar
59 Mixed Hardwoods

60 Oak - gum - cypress
61 Swamp chestnut oak-Cherrybark oak
62 Sweetgum-Nuttall oak-willow oak
63 Sugarberry-American elm-green ash
65 Overcup oak-water hickory
66 Atlantic white cedar
67 Baldcypress-water tupelo
68 Sweetbay-swamp tupelo-red maple

70 Elm - ash - cottonwood
71 Black ash-American elm-red maple
72 River birch-sycamore
73 Cottonwood
74 Willow
75 Sycamore-pecan-American elm

80 Maple - beech - birch
81 Sugar maple - beech - yellow birch

90 Aspen - birch
91 Aspen
92 Paper birch

95 Grassland

96 Marsh

97 Chaparral

99 Other - specify in remarks.

Item Codes (67) Stand Size
1. Saw timber
2. Pole timber
3. Sapling-seedlings
0. If a stand is not present

(68-70) Basal Area - of all sizes and species of trees

(71) Stocking
1. 70% +
2. 40-69%
3. Less than 40%
0. If unstocked.

Item Codes (8-10) (42-44) Disturbances and Causes
L. General logging-removal of timber canopy.
S. Skid trails
D. Landings
R. Spur roads
F. Fire
W. Wildlife
I. Insects
G. Grazing

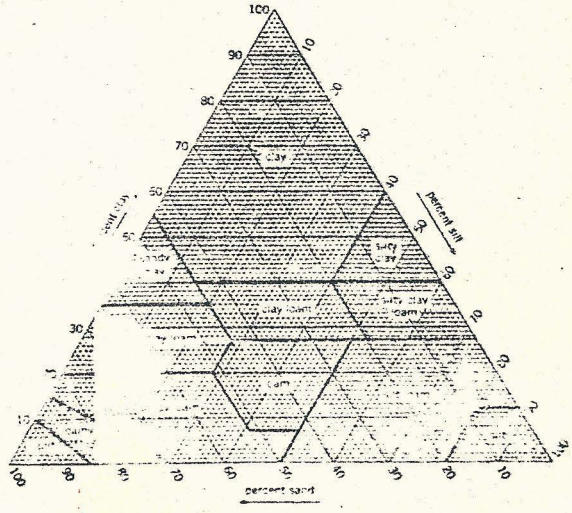
Site Preparation
K. KG blade
A. Root raking
C. Chopping
X. Discing
T. Straight blade
E. Bedding

M. Mining
Ø. Other
N. Natural

(41) Compaction - Humus
C. Compact
M. Moderately Compact
L. Loose - friable

GUIDE FOR ESTIMATING RUNOFF CURVE (K) VALUES

Soil Surface Texture 1/	Hydrologic Soil Group			
	A	B	C	D
Clays	0.24	0.29	0.32	0.37
Clay Loams	0.28	0.30	0.37	0.43
Loams	0.32	0.37	0.43	0.47
Sandy Loams	0.30	0.34	0.38	0.37
Sands	0.17 or .13	0.20	0.24	0.33

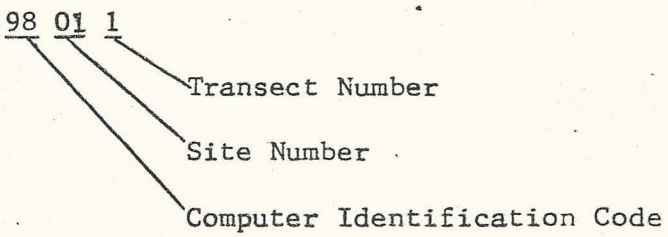


APPENDIX B

Explanation of Computer Readout not Identified in Field Form Instructions or on Readout

Strata:
- C - Cultural practice site
- H - Harvest site
- 1,2,3 - Division of Forest Resources region designation

Sequence Number: Numerical designation of site



LRA: Land Resource Area

130	Blue Ridge
133	Southern Coastal Plain
136	Southern Piedmont
137	Carolina and Georgia Sandhills

Weighted Erosion Rate: Sheet erosion figured for entire 10,000 square foot plot (100x100) and then expanded to a per acre basis.

Weighted Sediment Rate: Sheet sediment figured for entire 10,000 square foot plot (100x100) and then expanded to a per acre basis.

Runoff Curve Number: See attached chart.